

# **Status of MODIS Processing within SDPS and Future Plans**

*B. Franz, 11 June 2003  
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## **I. Introduction**

The SeaWiFS Data Processing System (SDPS) is now processing MODIS/Aqua data from Level-1A through Level-3 using a mix of standard MODIS codes and standard SeaWiFS/SIMBIOS codes (MODIS/Terra processing has been discontinued). The immediate goal of this effort is to establish the mechanics for processing and distributing global 1-km data, as a prototype for discipline-specific oceans processing of NPP/VIIRS. Another goal is to develop the capability for near-realtime image support using MODIS data, and to provide an alternative method for MODIS data browse and distribution. This effort is not intended to replicate current standard MODIS production.

The data products produced through this activity are currently available for download through the SeaWiFS browse utility, <http://seawifs.gsfc.nasa.gov/cgi/browse.pl>. The most recently processed data is also available via anonymous ftp from <ftp://oceans.gsfc.nasa.gov/>. Users of this data should be aware that this is a prototyping effort, and as such the products may be changed at any time to reflect the current state of software and algorithm development. The software and calibration are likely to change in the forward stream, and frequent reprocessings to bring the retrospective data in-line with the forward stream should be expected.

This document provides some details on the current status of MODIS processing within SDPS, with emphasis on the algorithmic differences between the products generated by SDPS and those produced by the MODIS Data Processing System (MODAPS). Plans for further development are also listed. This document will be maintained to reflect further changes in the processing software or calibration.

## **II. Major differences between SDPS and standard MODAPS processing**

- a. SeaWiFS-like file formats for Level-2 and higher
- b. SeaWiFS-like product suite with addition of 11um SST
- c. different aerosol model suite
  1. converted MODIS models and transmittance tables to SeaWiFS format
  2. using only 12 scattering models, rather than 16, and no absorbing models
  3. using SeaWiFS single-scattering to multi-scattering relationships
- d. different NIR water-leaving radiance correction (Arnone rather than Siegel)
- e. additional correction of nLw for out-of-band response
- f. different glint correction (SeaWiFS algorithm)
- g. different whitecap correction (SeaWiFS algorithm)
- h. different solar irradiance models (Thuillier 2003).
- i. no replacement of detector 1 pixels with detector 2 pixels

- j. no NIR smoothing

### III. Change History

- a. March 2003
  - 1. MS112 v3.1
  - 2. initial development o support MODIS processing
- b. June 2003
  - 1. MS112 v3.2
  - 2. replace SeaWiFS aerosol models with 12 equivalent MODIS models
  - 3. replace SeaWiFS diffuse transmittance tables with MODIS tables
  - 4. incorporate MODIS out-of-band water-vapor correction
  - 5. set 748-nm gain adjustment back to 1.0
  - 6. use correct ozone interpolation for TOMS
  - 7. **comparisons with standard MODIS software (modcol) show near identical results for nLw, chlorophyll, AOT, and epsilon, when modcol is run with no NIR Lw correction, no replacement of detector 1 with 2, and no optimization of the aerosol model selection process.**
- c. 7 July 2003
  - 1. MS112 v3.3
  - 2. begin deviation from standard MODIS processing algorithms.
  - 3. install MODIS-specific water absorption and backscatter coefficients for Arnone NIR water-leaving radiance correction, and enable correction.
  - 4. install MODIS-specific out-of-band correction coefficients for nLw, and enable nLw out-of-band correction.
  - 5. replace Cox & Munk glint probability distribution with Ebuchi & Kizu.
  - 6. modify cloud flag algorithm to remove glint reflectance, and reduce cloud flag reflectance threshold from 0.08 to 0.04.
- d. 13 August 2003
  - 1. MS112 v3.4
  - 2. add support for 11-12um SST product .
- e. 5 November 2003
  - 1. MS112 v3.5
  - 2. change glint correction to be consistent with SeaWiFS, including: correct interpretation of the glint coefficient ( $\mu_0/\pi$  error modcol), probability function reverted to Cox & Munk, no modcol scale factors, no modcol elevation of wind speeds, use of direct transmittance terms.
  - 3. add glint polarization components to polarization correction (as implemented for standard MODIS/Terra collection 4.1).
  - 4. change whitecap correction to be consistent with SeaWiFS (scale factor increased from 0.25 to 0.4, wind speed limited at 8 m/s).
  - 5. update to generalized earth-sun distance calculation.

6. replace Neckel & Labs solar irradiance model with Thuillier 2003.
7. update band-pass-integrated solar irradiances for MODIS/Aqua using newly developed relative spectral response functions, including measured out-of-band response.

#### **IV. Details of data ingest**

- a. acquiring MODIS/Terra and MODIS/Aqua Level-1A ocean color subsetting data (MOD01SS) from the Goddard DAAC
- b. removing extraneous data (500m bands, etc.) to minimize storage requirements
- c. renaming with SeaWiFS convention (T for Terra, A for Aqua)

#### **V. Details of geolocation**

- a. running Univ. of Wisconsin, IMAPP version of MODIS geolocation
- b. modified to include standard ECS meta-data structure
- c. using definitive attitude and ephemeris from GDAAC

#### **VI. Details of Level-1B processing**

- a. running standard MCST code (v4.2.x Aqua, v4.2.x Terra)
- b. modified to handle a sub-sampled (GAC) Level-1A more efficiently
- c. using latest, measured m1 LUTs for forward stream
- d. testing alternative smoothed LUTs in reprocessing stream

#### **VII. Details of Level-2 processing**

- a. running MS112, modified to read and process MODIS/Terra and MODIS/Aqua Level-1B, full-resolution or extract (diagnostic data set)
- b. reading and applying RSMAS radcor corrections (terra\_v15\_55.col, aqua\_v1\_6.col)
- c. using standard MODIS Rayleigh tables (with I,Q,U components)
- d. reading and applying standard MODIS polarization corrections
- e. using SeaWiFS glint correction algorithm
- f. using SeaWiFS white-cap correction algorithm
- g. using MODIS aerosol and transmittance tables for 12 models (o99,m50,m70,m90,m99,c50,c70,c90,c99,t50,t90,t99).
- h. using SeaWiFS single-scattering to multi-scattering relationships.
- i. using standard SeaWiFS flagging and masking, with cloud flag based on glint-subtracted surface reflectance at 869 nm. Same cloud flag for SST.
- j. using Arnone NIR water-leaving radiance correction, adjusted for MODIS
- k. applying correction for out-of-band response to nLw, based on convolution of MODIS band relative spectral response with Morel bio-optical model
- l. no NIR smoothing
- m. no replacement of detector 1 pixels with detector 2 pixels

- k. chlorophyll product using MODIS chlor\_a2 (OC3M) algorithm, but alternate algorithms are available
- l. SST product using standard MODIS 11um nlsst algorithm and coefficients with SSTguess from pathfinder climatology

### **VIII. Details of Level-3 processing**

- a. using standard SeaWiFS code and formats
- b. no quality levels

### **IX. Future development plans**

- a. develop independent vicarious calibration and characterization procedures for MODIS, and derive new calibration tables consistent with algorithm changes
- b. build historical database of ephemeris files to support reprocessing
- c. make use of standard MODIS aerosol tables (consolidated HDF format, also change SeaWiFS to use the HDF table format)
- d. allow runtime specification of the aerosol model suite
- e. incorporate MODIS absorbing aerosol correction?
- f. build capability for Level-1A extract and processing
- g. support for night data
- h. SeaDAS distribution